

October 1971

Brief 71-10398

NASA TECH BRIEF

Lewis Research Center



NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Steady Temperature and Density Distributions in a Gas Containing Heat Sources

A digital computer program, STADDIG, calculates axial temperature and density distributions in a stagnant gas containing heat sources and contained within an annulus. In a nuclear reactor, when a neutron-absorbing gas is exposed to a neutron flux, the spatial distribution of the mass of gas (gas density) must be known because of its influence on the spatial distribution of neutrons and the resulting effects on reactor criticality.

The program is based on a steady-state, one-dimensional (radial) heat-transfer calculation using cylindrical coordinates. The gas density is related to the gas temperature through the perfect gas law. The program allows for conduction across the gas and across the container walls. Heat is dissipated from the container walls by forced-convection cooling with an incompressible coolant. Heat sources are included in the coolant, the gas, and the container walls.

The axial distribution of gas temperature and density is determined by successive radial heat-transfer calculations at different axial positions. Axial heat conduction is neglected. A typical problem con-

taining 20 axial increments requires about 4 seconds of running time when the gas densities and thermal conductivities are required to converge within 0.1 and 1%, respectively. Changing the convergence requirements has no appreciable influence on the problem running time.

Notes:

1. This program is written in FORTRAN IV for use on the IBM-7094 computer.
2. Requests for further information may be directed to:

COSMIC
112 Barrow Hall
University of Georgia
Athens, Georgia 30601
Reference: B71-10398

Patent status:

No patent action is contemplated by NASA.

Source: H. W. Davison
Lewis Research Center
(LEW-10905)

Category 09